THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN BUILDING & CIVIL ENGINEERING

EBC 4221: STRENGTH OF MATERIALS II

SPECIAL/SUPPLEMENTARY EXAMINATON
SERIES: OCTOBER 2011
TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Battery Powered Programmable Calculators*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **FOUR** printed pages

SECTION A (COMPULSORY)

Question 1

a) A hollow circular shaft is being designed to transmit 120KW at 1.75Hz. The inside diameter of the shaft is to be one-half of the outside diameter. Assuming that the allowable shear stress is 45 Mpa, calculate the minimum required outside diameter d. (14 marks)

b) A strut has the following cross section:

Harsh

In the length of the strut is 3.0 calculate the Euler buckling load if;

i) Both ends of the strut are pinned
ii) Both ends of the struts are fixed
iii) One end is fixed and the other pinned

Take E = 210GN/m2. (16 marks)

SECTION B (Answer *any TWO questions from this section*)

Question 2

a) A hollow circular tube of metal is subjected to twisting by torques T applied the ends. The bar has a length L=0.5m and the inside and outside diameters are 30mm and 40mm, respectively. It is determined by measurement that the angle of rotation ϕ is 0.068 radians when the torque T is 650Nm. Calculate the shear modulus of elasticity G for the material. (8 marks)

b) A wood beam of dimensions b = 200mm and h = 300mm is reinforced on its sides by steel plates 12 mm thick. The moduli of elasticity for the steel and wood are E_s = 204Gpa and E_w = 8.5Gpa, respectively. Also the corresponding allowable stresses are σ_s = 130Mpa and σ_w =8.5Mpa. Calculate the maximum allowable bending moment M_{max} about the x-axis. (12 marks)

Question 3

A simply supported composite beam is loaded with a single concentrated load P at midspan. The beam has a span of 4m and is made of wood section (b=150mm and h = 250mm) reinforced with a steel plate 150mm wide by 10mm thick at its lower side. Determine the minimum load P if the allowable stresses in wood and steel are Mpa and 100 Mpa respectively. Take Young's modulus to be 210 Gpa for steel and 10 Gpa for wood. (20 marks)

Question 4

A beam has the following cross-section:

If it is subjected to an axial load of 180KN and a sagging moment of 24 KNm, determine the maximum compressive and tensile stresses acting on the beam if the axial load were both compressive and tensile. (20 marks)

Question 5

Determine the earth pressure distribution for the retaining wall shown:

Use the following data:

γ_m for wall material = 24KN/m^3

γ_s for wall soil = 18KN/m^3

ϕ Angle of internal friction = 35^o

Retained soil slopes at 25^o to the horizontal

Assume same soil retained on both sides of the wall.